REMARKS / ARGUMENTS

This application is believed to be in condition for allowance because the claims are believed to be non-obvious and patentable over the cited references. The following paragraphs provide the justification for this belief. In view of the following reasoning for allowance, the Applicant hereby respectfully requests further examination and reconsideration of the subject patent application.

1.0 Rejections under 35 U.S.C. §101:

In the Office Action of April 1, 2009, claims 1-11 were rejected under 35 U.S.C. §101 as being directed towards non-statutory subject matter. In particular, the Office Action suggests that the claimed "…computer-readable medium…" in the preamble of independent claim 1 can be interpreted as including a "carrier wave" which is non-statutory subject matter.

In response, Applicants have amended independent claim 1 to recite a "…***physical*** computer-readable ***storage media*** encoded with a computer program having computer executable instructions…" Dependent claims 2-11 have been similarly amended to recite the claimed "…***physical*** computer-readable ***storage media***…" limitation. Applicants believe that these amendments are sufficient to overcome the rejection of claims 1-11 under 35 U.S.C. §101. Further, by inclusion of the term "***physical*** computer-readable ***storage media***" in the preamble of claim 1, Applicants respectfully suggest that it is not necessary to amend the specification as suggested by the Examiner.

Consequently, Applicants respectfully request withdrawal of the rejection of claims 1-11 under 35 U.S.C. §101 in view of the aforementioned amendments to claims 1-11.

2.0 Rejections under 35 U.S.C. §103(a):

The Office Action rejected claims 1-11 under 35 U.S.C. §103(a) as being unpatentable over ***Straasheijm*** (U.S. Patent 6,968,009) in view of ***Ma*** (U.S. Patent 7,072,398), in further view of ***Tomizawa*** (U.S. Patent 6,208,690).

In order to deem the Applicant's claimed invention unpatentable under 35 U.S.C. §103(a), a prima facie showing of obviousness must be made. However, as fully explained by the M.P.E.P. Section 706.02(j), to establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, ***to modify the reference*** or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, ***the prior art reference (or references when combined) must teach or suggest all the claim limitations***.

Further, in order to make a prima facie showing of obviousness under 35 U.S.C. 103(a), all of the claimed elements of an Applicant's invention must be considered, especially when they are missing from the prior art. If a claimed element is not taught in the prior art, then no prima facie case of obviousness exists. The Federal Circuit court has stated that it was error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein (*In Re Fine*, 837 F.2d 107, 5 USPQ2d 1596 (Fed. Cir. 1988)).

2.1 Rejection of Claims 1-11:

In the present Office Action, independent claim 1 is again rejected under 35 U.S.C. §103(a) based on the suggestion that the proposed ***Straasheijm–Ma–Tomizawa*** combination reference discloses the Applicants claimed "…computer program… for automatically estimating a motion field for image frames in an image

sequence…" However, as discussed in further detail below, Applicants believe that the Office Action continues to misinterpret the cited references and the elements of the claimed invention.

For example, in the "Response to Arguments" section of the present Office Action (page 2, second paragraph), the following argument is advanced:

> "On pages 4-5, applicant argues that Ma fails to disclose a second level, identification, or evaluation using the irregular MV's. While the applicant's points are understood, the examiner respectfully disagrees. See for example Ma column 10, lines 60-65. There Ma discloses determining true MV's from irregular MV's. Ma further discloses in column 11, lines 30-35, a second level involving the use of the irregular MV's. Therefore the rejection has been maintained."

First, Applicants respectfully suggest that in contrast to the position advanced by the Office Action, ***Ma*** does ***not*** disclose "…determining true MV's ***from*** irregular MV's…" (emphasis added). In particular, column 10, line 49 through col. 12, line 11 of the ***Ma*** reference describes a ***filtering process*** that uses a "…three-level decision making process to ***classify each MV to be one of the four identified MV types***…" (emphasis added). As explained by ***Ma***, and as illustrated by Figure 13(b) of the ***Ma*** reference, these "MV types" include 1) "Uncorrupted" MVs; 2) "Isolated irregular" MVs; 3) "Non-isolated irregular 2MVs"; and 4) "Edge" MVs. The various types of MVs described by the ***Ma*** reference are then used in defining filter parameters (see col. 12, lines 12-40 of the ***Ma*** reference) that are used to provide motion field denoising operations. Again, it is important to understand that ***in direct contradiction to the position advanced by the Office Action*** that ***Ma*** fails completely to describe "…determining true MV's ***from*** irregular MV's…" In other words, ***Ma*** identifies various types of MVs, but does ***not*** convert one type to another. As such, the Arguments presented by the Office Action in the "Response to Arguments" section are without support.

In addition, as noted above, the "Response to Arguments" section of the present Office Action also argues that "Ma further discloses in column 11, lines 30-35, ***a second level*** involving the use of the irregular MV's." (emphasis added). However, the "second level" disclosed by ***Ma*** is merely the second step of the "…three-level decision making process to ***classify each MV to be one of the four identified MV types***…" as explained in column 10, lines 54-56 of the ***Ma*** reference. More specifically, column 11, lines 30-35 of the ***Ma*** reference simply explains: "The second level involves the identification of isolated irregular MVs." It is important to understand that this "second level" refers to the ***second level of the three level decision process that merely identifies different types of MVs, as illustrated by Figure 13(b)***. In other words, as previously explained by Applicants, it should be clear that the ***Ma*** reference does ***not*** disclose "…a second level, identification or evaluation ***using*** the irregular MVs…" since the "second level" disclosed by ***Ma*** merely ***identifies*** "irregular MVs".

Further, with respect to the arguments presented with respect to the ***Tomizawa*** reference, in the "Response to Arguments" section (page 2, first paragraph), the present Office Action argues the following in view of column 9, lines 39-45 of the ***Tomizawa*** reference:

> "…Tomizawa discloses storing the error values thus saving the amount of calculating operations. Since Tomizawa saves the number of calculations, the error values are retrieved instead of being re-computed. The affine transformations of the triangle areas are the way the error values are computed, and then subsequently are stored."

The Office Action offers this argument in support of the proposition that the ***Tomizawa*** reference teaches the claimed limitations relating to use of error values for evaluating the second set of candidate MVs. Further, as previously explained by the Applicants, this second set of MVs represents "…a second set of one or more candidate

MVs for each block in the image frame for which the first set of zero valued MVs was deemed ***not reliable***..."

However, column 9, lines 39-45 of the ***Tomizawa*** reference specifically recites the following language:

> "According to the present invention, it is possible to store prediction-error estimation values obtained by affine transformation for respective triangular areas, thus reducing the number of the affine transformations and correspondingly saving amount of the calculating operations. This eliminates the need for repeating searching motion-vectors, thus improving the efficiency of processing." (emphasis added)

As previously explained by the Applicants, "prediction-error" values from the affine transformations of the triangular areas described by the ***Tomizawa*** reference "...***eliminates*** the need for repeating searching motion-vectors..." as described by the ***Tomizawa*** reference.

However, Applicants use the claimed error values to ***further evaluate candidate motion vectors***. Consequently since the ***Tomizawa*** reference describes a process for eliminating the need to search motion vectors, Applicants respectfully suggest that it clearly fails to disclose the claimed limitations regarding the evaluation of a second set of candidate motion vectors based on a computed reliability of a first set of motion vectors. As such, there is no equivalency between the affine transform-based "prediction-error values" and the claimed storage of error values for candidate motion vectors. Specifically, Applicants claim the following with respect to this point:

> "...wherein evaluating the second set of one or more candidate MVs for each block further comprises computing an error value for each candidate MV and storing that error value to a database the first time that each candidate MV is

evaluated, and then retrieving that error value from the database instead of re-computing the error value whenever it is necessary to evaluate any candidate MV again when evaluating MVs in neighboring blocks…"

In addition, as explained in several of the Applicants prior responses, Applicants also maintain that the Office Action has also mischaracterized the ***Straasheijm*** reference. For example, the arguments regarding the ***Straasheijm*** reference in the present Office Action are identical to those presented in the previous Office Action (dated September 30, 2008). In the previous Office Action, the Examiner argued the following: "The examiner relied upon Straasheijm to teach evaluating a second and third set of MV's in which Straasheijm discloses in figure 5 and column 4, lines 42-54."

However, as previously explained by Applicants the ***Straasheijm*** reference discloses computing a rough or initial estimate of motion vectors (MVs) using a "rough search" of a low resolution scaled image frame. This rough search is then refined in a second search of a higher resolution scaled image frame. Finally, a third level search refines the results of the second level search by using those results to guide the search of a full resolution image frame. This three level search is fully detailed in FIG. 5 of the ***Straasheijm*** reference and in col. 4, lines 3-55. In particular, FIG. 5 includes "STEP 0", "STEP 1", "STEP 2(i)", and "STEP 2(ii)". The descriptions of these steps, as described in col. 4, lines 3-55 are summarized below:

1. STEP 0: Given a full resolution image frame, generate two scaled frames of successively lower resolution than the full image frame.

2. STEP 1: Search the lowest resolution scaled image frame to identify rough MVs in the lowest resolution image frame.

3. STEP 2(i): Search the higher resolution scaled image frame using the rough MVs identified in STEP 1 to identify intermediate MVs in the higher resolution scaled image frame.

4. STEP 2(ii): Search the full resolution image frame using the intermediate MVs identified in STEP 2(i) to identify final MVs in the full resolution image frame.

Again, it is important to understand here that the ***Straasheijm*** reference is simply using MVs identified in a low resolution image frame to guide a search for corresponding MVs in successively higher resolution copies of the same image frame. In fact, only those MVs that are actually identified as ***valid*** MVs in a low resolution image frame are used to guide the search in the next higher resolution copy of that image frame. In constrast, the claimed invention operates at the second and subsequent levels based on searches of MVs that are deemed as ***unreliable***, or ***invalid***, in the lower level searches. As such, the ***Straasheijm*** reference simply does not disclose the features for which it is offered.

Further, as previously explained by Applicants, ***Straasheijm*** identifies only ***valid*** (presumably reliable) motion vectors in a low resolution copy of an image. Combining this concept with Ma's termination of the block search for matches below the threshold will presumably not change the results of the ***Straasheijm*** first level search since ***Straasheijm*** intends to provide only valid or reliable rough motion vectors for the next level search. This process then repeats for two more search levels with successively higher resolution copies of the same image frame. Thus, ***Straasheijm–Ma–Tomizawa*** will pass only ***valid*** motion vectors to the next level search, with those ***valid*** motion vectors being used to guide the next level search.

Consequently, since Applicants specifically identify those blocks "…for which the first set of zero valued MVs was deemed not reliable…" for the claimed level based

searches, the ***Straasheijm–Ma–Tomizawa*** combination reference fails to disclose these features. In particular, following the identification of unreliable blocks at the first level search, Applicants continue the search of the unreliable blocks by "…evaluating a second set of one or more candidate MV…" for those unreliable blocks. As claimed by the Applicants, a similar search is then performed using a third set of MV's for unreliable blocks of the second search.

Clearly, Applicants claim a technique that includes specifically continuing to search subsequent sets of motion vectors for ***unreliable*** blocks. Conversely, ***Ma*** terminates searches for block matches below the threshold. Therefore, ***Ma*** specifically teaches termination of further search in the exact instance where Applicants specifically claim continuation of the search. Therefore, the proposed ***Straasheijm–Ma–Tomizawa*** combination reference clearly fails to teach or in any way disclose the claimed limitations regarding the novel search processes claimed by Applicants.

Thus, it is clear that the present invention, as claimed by independent claim 1 includes elements not taught in the proposed ***Straasheijm–Ma–Tomizawa*** combination reference, or in any way rendered obvious by the proposed ***Straasheijm–Ma–Tomizawa*** combination reference. Consequently, the rejection of independent claim 1 and of dependent claims 2-11, under 35 U.S.C. §1 03(a) is not proper. Therefore, the Applicants respectfully traverse the rejection of claims 1-11 under 35 U.S.C. §103(a), and respectfully request reconsideration of the rejection of these claims in view of the novel language of claim 1. In particular, claim 1 recites the following novel language:

> "A physical computer-readable storage media encoded with a computer program having computer executable instructions for automatically estimating a motion field for image frames in an image sequence, said computer executable instructions comprising:

evaluating a first set of zero valued motion vector (MVs) for blocks in an image frame using background detection and determining a reliability of each MV;

evaluating a second set of one or more candidate MVs for each block in the image frame for which the first set of zero valued MVs was deemed not reliable, said second set of MVs being determined using any of spatial and temporal neighbors of each of those blocks, and determining an optimal MV for each block of the second set and a reliability of each optimal MV;

wherein evaluating the second set of one or more candidate MVs for each block further comprises computing an error value for each candidate MV and storing that error value to a database the first time that each candidate MV is evaluated, and then retrieving that error value from the database instead of re-computing the error value whenever it is necessary to evaluate any candidate MV again when evaluating MVs in neighboring blocks;

evaluating a third set of candidate MVs for all blocks in the image frame having MVs that were deemed not reliable using the first or the second set of MVs, said third set of MVs being determined using a block-based pattern search, and determining an optimal MV for each block of the third set; and

outputting an optimal MV for each block using the reliable MVs from the first, second and third sets of MVs to form a motion field for the image frame."

CONCLUSION

In view of the above, it is respectfully submitted that claims 1-11 are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of claims 1-11 and to pass this application to issue. Additionally, in an effort to further the prosecution of the subject application, the Applicant kindly invites the Examiner to telephone the Applicant's attorney at (805) 278-8855 if the Examiner has any questions or concerns.

Respectfully submitted,

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